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by

J. S. GUPTA and PAUL NEERGAARD

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DETECTION OF CHLAMYDOSPORES OF *PROTOMYCES MACROSPORUS* UNG. IN INDIAN SEED LOTS OF CORIANDER

by

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Introduction

Stem-gall disease of coriander is caused by *Protomyces macrosporus* Ung. which induces tomour-like swelling and hypertrophies in the aerial portions of the host including the fruits. Fully hypertrophied fruits are rendered ungerminable while diseased fruits where infection reaches late and confines to the pericarp, can germinate (Gupta 1962). At maturity, in a diseased plant all gradiations of infection can be seen ranging from umbels with all fruits hypertrophied to umbels with partially affected hypertrophied fruits. In the same plants some umbels may be affected and the rest completely healthy. In India, at the time of harvest, farmers collect coriander plants by cutting them at the base and placing them for drying in their farm yard. After thrashing the seeds are stored.

The disease recurs in fields due to the presence of chlamydospores of *Protomyces macrosporus* which adhere to normal healthy seeds at the time of thrashing or by directly contaminating the soil through the diseased plant debris. The chlamydospores are viable for 4–5 years. In the present investigations 32 coriander seed lots from India were examined for the presence of chlamydospores of *Protomyces macrosporus* and the findings are incorporated in this paper.

1. Materials and Methods

The 32 seeds lots of coriander were collected from the States of Madhya Pradesh, Uttar Pradesh, Rajasthan, and Delhi, including both local and improved cultivars. Dry seeds of all the samples were examined both by naked eye and by stereomicroscope. Two sets of 25 cremocarps from each seed lot were shaken on an electric shaker for 10 minutes in 10 ml of distilled water, and later the liquid was centrifuged for 3 minutes. After pouring off the supernatant liquid, the residue was examined under the compound microscope for the presence of chlamydospores of *Protomyces macrosporus*. These are more or less spherical, three layered, golden yellow, and range from 45–55 μ in diameter (fig. 1).

2. Experiments

(1) Inspection of dry seeds

The naked eye as well as stereomicroscope examination revealed that out of 32 seeds lots, hypertrophied seeds (fig. 2) were present in 9 seeds lots. Seven of these seed lots belong to the State of Madhya Pradesh, and two to Uttar Pradesh. The samles represented local varieties drawn from the stock of farmers. In the remaining 23 seed lots the seeds were normal and healthy, and there was no apparent sign of infection.

(2) Detection of chlamydospores removed from seeds after washing

The washings collected from different seed lots were examined for the presence of chlamydospores of *Protomyces macrosporus* and their number was recorded. The results are tabulated in Table 1.

It appears from the table that out of 32 seed lots 21 were contaminated with the chlamydospores of *Protomyces macrosporus*. As expected the 9 samples from Madhya Pradesh and Uttar Pradesh having hypertrophied

Table 1. Detection of chlamydospores in 32 Indian seeds lots of coriander.

Name of the State	No. of seed lots examined	No. of seed lots showing chlamydospores	Frequency of contamination in seed lots	Estimated amount of chlamydospores
Madhya Pradesh ..	7	7	3	+
			1	++
			2	+++
			1	++++
Uttar Pradesh	4	4	2	+
			1	++
			1	+++
Rajasthan	12	5	2	+
			1	++
			1	+++
			1	++++
New Delhi	9	5	3	+
			1	+++
			1	++++
Total	32	21		

\+ few chlamydospores
++ rather few
+++ many
++++ abundant

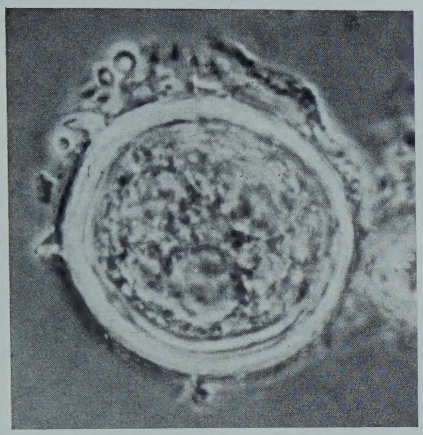

Fig. 1. Protomyces macrosporus Ung.
Chlamydospore. x 600.

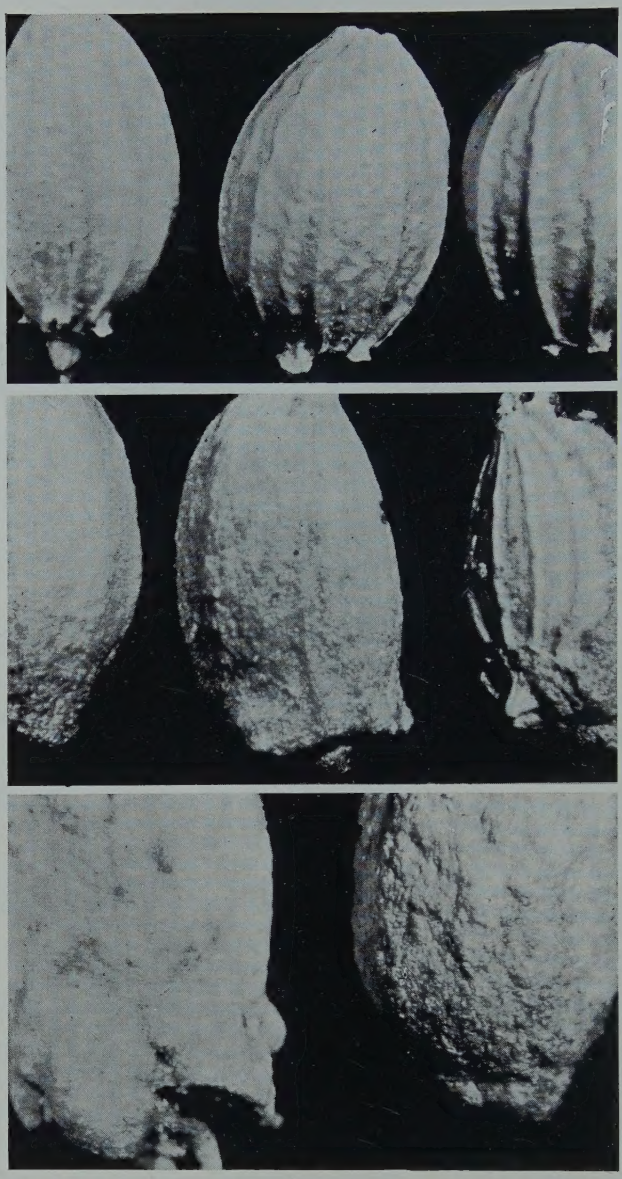

Fig. 2. Seeds (cremocarps) of *Coriandrum sativum*, deformed due to *Protomyces macrosporus* Ung.
Top figure: Normal, healthy fruits, the vittae ("riba") clearly visible.
Middle figure: Partly hypertrophied fruits, the vittae visible on a part of the fruit at right only.
Lowest figure: Totally hypertrophied cremocarps, on which the normal structure of the fruit disappeared.
x 10.

fruits were found contaminated. About half of the seed lots from Rajasthan and Delhi, which were normal and apparently healthy, showed the presence of chlamydospores of the pathogen that could not be detected by stereomicroscopic examination. The variation in the frequency of contamination, though somewhat higher in seed lots possessing hypertrophied seeds, was also seen in the samples where all seeds were apparently healthy and normal. Obviously, even apparently healthy looking seed lots may carry the viable inoculum and thus escape notice of farmers and seed growers.

3. Discussion

In India coriander is cultivated in almost all the provinces and considered as an important subsidiary crop occupying a substantial acreage in the country. The stem-gall of coriander caused by *Protomyces macrosporus* is reported to be prevalent in Madhya Pradesh, Uttar Pradesh, Bihar, Punjab, and in some areas of Rajasthan. So far there is no report in literature about the existence of the disease in the rest of the provinces of the country.

With the indescriminate movement of seed lots from zones where the disease is prevalent, there appears to be a possibility of introducing the pathogen, including its biological forms or races (Gupta & Sinha 1963, 1964), into provinces or even in areas within the province of origin of the disease, where so far it does not exist. This may further result in formation of new races of the parasite due to chances of hybridization of nuclei of sporangiospores which are produced at the time of germination of chlamydospores. An attempt should be made to restrict the organism and its spread by organization of an appropriate seed certification scheme, with the aim of providing disease-free seed lots to farmers by growing seeds in areas where the disease is not prevalent.

Summary

Stemgall disease of coriander caused by *Protomyces macrosporus*. Ung. induces hypertrophies in the aerial portions of the host including fruits. The recurrence of the disease takes place through the germination of the chlamydospores of the parasite which contaminate both soil and seed. 32 seed lots of coriander (local and improved cultivars) collected from the States of Madhya Pradesh, Uttar Pradesh, Rajasthan, and Delhi in India were investigated for the presence of

chlamydospores by microscopic examination of their seed washings. The results indicated that even apparently healthy seed lots may carry inoculum in the form of chlamydospores. In order to confine the pathogen and check its further spread to areas where the disease is not prevalent, seed certification schemes should be organized, including microscopic examination of seed washings as the appropriate method for the detection of chlamydospores.

Résumé

Detection des chlamydospores de Protomyces macrosporus *ung. dans les lots de semences indiens de coriandre*

La maladie de la galle des tiges du coriandre, provoquée par le *Protomyces macrosporus* Ung., entraine l'hypertrophie des parties aériennes de l'hôte, y compris les fruits. La réapparition de la maladie est dûe à la germination des chlamydospores du parasite, qui contaminent à la fois le sol et les semences. On a cherché à détecter la présence de chlamydospores dans 32 lots de semences de coriandre (cultivars locaux et cultivars améliorés) provenant des Etats de Madhya Pradesh, Uttar Pradesh, de Rajasthan et de Delhi, aux Indres, en examinant au microscope les eaux de lavage des semences. D'après les résultats, même les lots de semences apparemment saines peuvent contenir de l'inoculum sous la forme de chlamydospores. Pour isoler l'agent pathogène et l'empêcher d'atteindre les zones où la maladie ne règne pas, il faut adopter des méthodes de certification incluant l'examen des eaux de lavage des semences, au microscope, méthode appropriée pour la détection des chlamydospores.

Zusammenfassung

Feststellung von Chlamydosporen von Protomyces macrosporus *Ung. in indischen Saatgutpartien von Coriander*

Stammgallenerkrankung bei Coriander, die durch *Protomyces macrosporus* Ung. hervorgerufen wurde, induziert in den oberirdischen Teilen der Wirtspflanze einschl. deren Früchte Hypertrophien. Das Wiederauftreten dieser Krankheit findet durch die Keimung der Chlamydosporen auf den Parasiten statt, welche sowohl den Boden als auch den Samen befällt. 32 Samenpartien von Coriander (lokale und verbesserte Cultivars), die in den Staaten von Madhya Pradesh, Uttar Pradesh, Rajasthan und Delhi in Indien gesammelt waren, wurden auf das Vorkommen von Chlamydosporen in deren Samenspülwasser mikroskopisch untersucht. Die Ergebnisse zeigten an, daß selbst augenscheinlich gesunde Partien Träger in Form von Chlamydosporen sein können. Um diesen Krankheitserreger einzugrenzen und seine Weiterverbreitung in Gebieten, in denen die Krankheit noch nicht vorkommt, zu überprüfen, sollte ein Saatgutzertifizierungsschema organisiert werden, das auch die mikroskopische Prüfung des Samenwaschwassers nach der für die Feststellung von Chlamydosporen angewandten Methode einschließt.

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